

POSTER PRESENTATION**Open Access**

Cine Displacement ENcoding imaging with Stimulated Echoes (cine-DENSE) confirms systolic myocardial dysfunction in asymptomatic patients with type 2 diabetes mellitus: comparison with MR-tagging

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Introduction

Diabetic cardiomyopathy contributes to increased cardiovascular mortality in diabetes mellitus (DM) patients and is characterized by a progressive alteration of left ventricular (LV) function. At a preclinical stage, a decrease in systolic myocardial strain has been suggested in echocardiographic studies.

MRI techniques remain the gold standard for quantification of myocardial deformation but only a single study suggested systolic abnormalities in type 2 DM patients with evidence of diastolic dysfunction.

MR-tagging is the most common technique for strain calculation using CMR but is intrinsically limited in measuring transmural variations. Cine-Displacement ENcoding Imaging with Stimulated Echoes (DENSE) has been recently proposed as an alternative that benefits from an increased spatial resolution.

Purpose

To evaluate whether cine-DENSE and MR-tagging confirm the existence of a sub-clinical myocardial dysfunction in a population of type 2 DM patients with no sign or history of heart disease and normal conventional echo and MRI parameters.

Methods

37 patients with type 2 DM (50.6±5.6 years, 8 females, HbA1c 7.6±1.2%) and 21 age-matched controls (49.7±8.0 years, 11 females) underwent a CMR study on a 1.5T scanner. Subjects were excluded if standard echocardiography showed significant abnormality. After a standard CMR study for conventional LV function assessment, two-dimensional cine-DENSE pulse sequence with short-echo train echo-planar imaging readout and cine-tagging with complementary spatial modulation of magnetization (CSPAMM) were acquired in short axis views at the same basal, mid and apical levels. LV volumes and ejection fraction were measured on cine-MRI images. Regional circumferential maximal systolic strain (ϵ_c) was calculated from cine-DENSE and MR-tagging acquisitions on 16 LV segments. Average maximal systolic strain in each slice and a whole heart mean value (ϵ_c mean) for each patient were calculated. Post-processing of cine-DENSE acquisitions included adaptive phase-unwrapping and spatial filtering. CSPAMM images were processed using *InTag* post-processing toolbox (Creatis, Lyon, France) implemented in OsiriX software (Geneva, Switzerland) with motion estimation based on the *Sine Wave Modeling* approach.

Results

Standard cine-MRI LV function parameters were normal and comparable between groups (table 1). Whereas LV ejection fraction was similar in the 2 groups, cine-DENSE

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Table 1 Left ventricular function in type 2 diabetes mellitus patients and controls

	DM patients	Controls	P
LVEDV (mL)	120 ± 26	129 ± 28	0.26
LVESV (mL)	41 ± 12	41 ± 12	0.90
LVEF (%)	66 ± 6	68 ± 6	0.30
ϵ_c base MR-tagging	-0.173 ± 0.040	-0.200 ± 0.028	0.004
ϵ_c mid MR-tagging	-0.177 ± 0.045	-0.220 ± 0.035	<0.001
ϵ_c apex MR-tagging	-0.189 ± 0.056	-0.232 ± 0.025	<0.001
ϵ_c mean MR-tagging	-0.179 ± 0.045	-0.216 ± 0.025	<0.001
ϵ_c base cine-DENSE	-0.134 ± 0.019	-0.155 ± 0.019	<0.001
ϵ_c mid cine-DENSE	-0.150 ± 0.021	-0.174 ± 0.020	<0.001
ϵ_c apex cine-DENSE	-0.153 ± 0.022	-0.193 ± 0.018	<0.001
ϵ_c mean cine-DENSE	-0.144 ± 0.016	-0.171 ± 0.016	<0.001

LVEDV= left ventricular end-diastolic volume; LVESV= left ventricular end-systolic volume; LVEF= left ventricular ejection fraction; ϵ_c =Regional circumferential maximal systolic strain.

showed a significant decrease in ϵ_c at basal, mid and apical LV level and in ϵ_c mean in the DM group as compared to controls. MR-tagging confirmed a decrease in ϵ_c at the 3 LV levels and in ϵ_c mean in DM patients as compared with controls.

Conclusions

Cine-DENSE and MR-tagging confirm subclinical myocardial dysfunction in asymptomatic patients with Type II DM.

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